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Weishew

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[54] **METHOD OF AND APPARATUS FOR LOADING A WIPER ROLL AGAINST AN ANILOX ROLL**

[76] Inventor: **Joseph John Weishew**, 1618 Pennsylvania Ave., Oreland, Pa. 19075

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[51] **Int. Cl.**[6] **B41F 31/00**

[52] **U.S. Cl.** **101/485**; 101/349; 118/681; 118/708

[58] **Field of Search** 101/349, 485, 101/350, 148, 170, 351, 348, 367, 352; 118/708, 668, 679, 680, 681, 682

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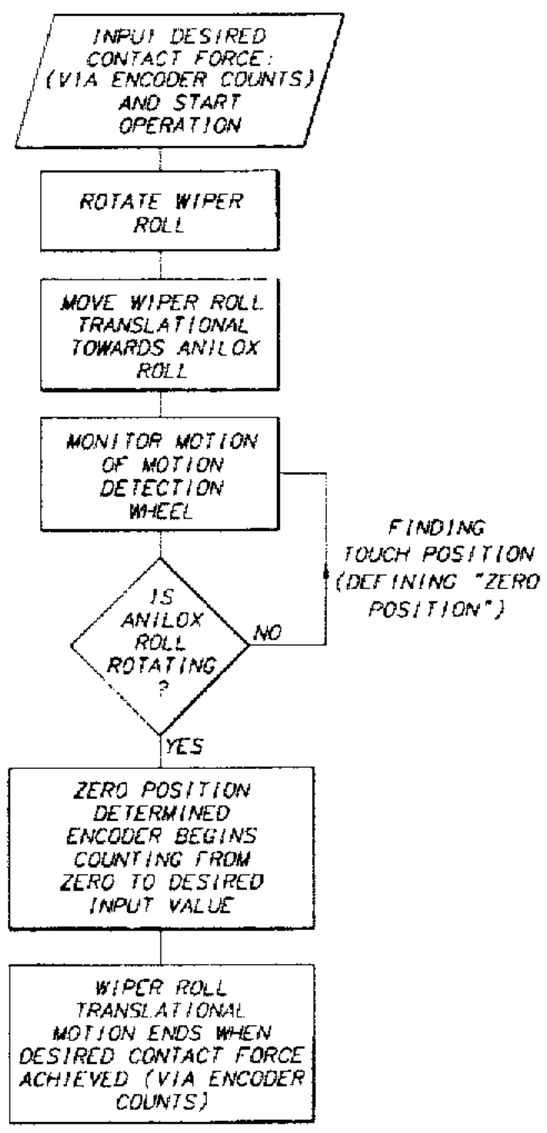
Primary Examiner—Eugene H. Eickholt

Attorney, Agent, or Firm—Seidel Gonda Lavorgna & Monaco, P.C.

[57] **ABSTRACT**

A method of and apparatus for loading a wiper roll against an anilox roll, wherein the wiper roll and the anilox roll each have a longitudinal rotational axis. The wiper roll is rotated about its longitudinal rotational axis and moved in a translational direction towards the anilox roll. A controller detects rotational movement of the anilox roll and stops the translation movement of the wiper roll towards the anilox roll at a specific time after detecting the rotational movement of the anilox roll in order to properly load the wiper roll against the anilox roll.

9 Claims, 6 Drawing Sheets



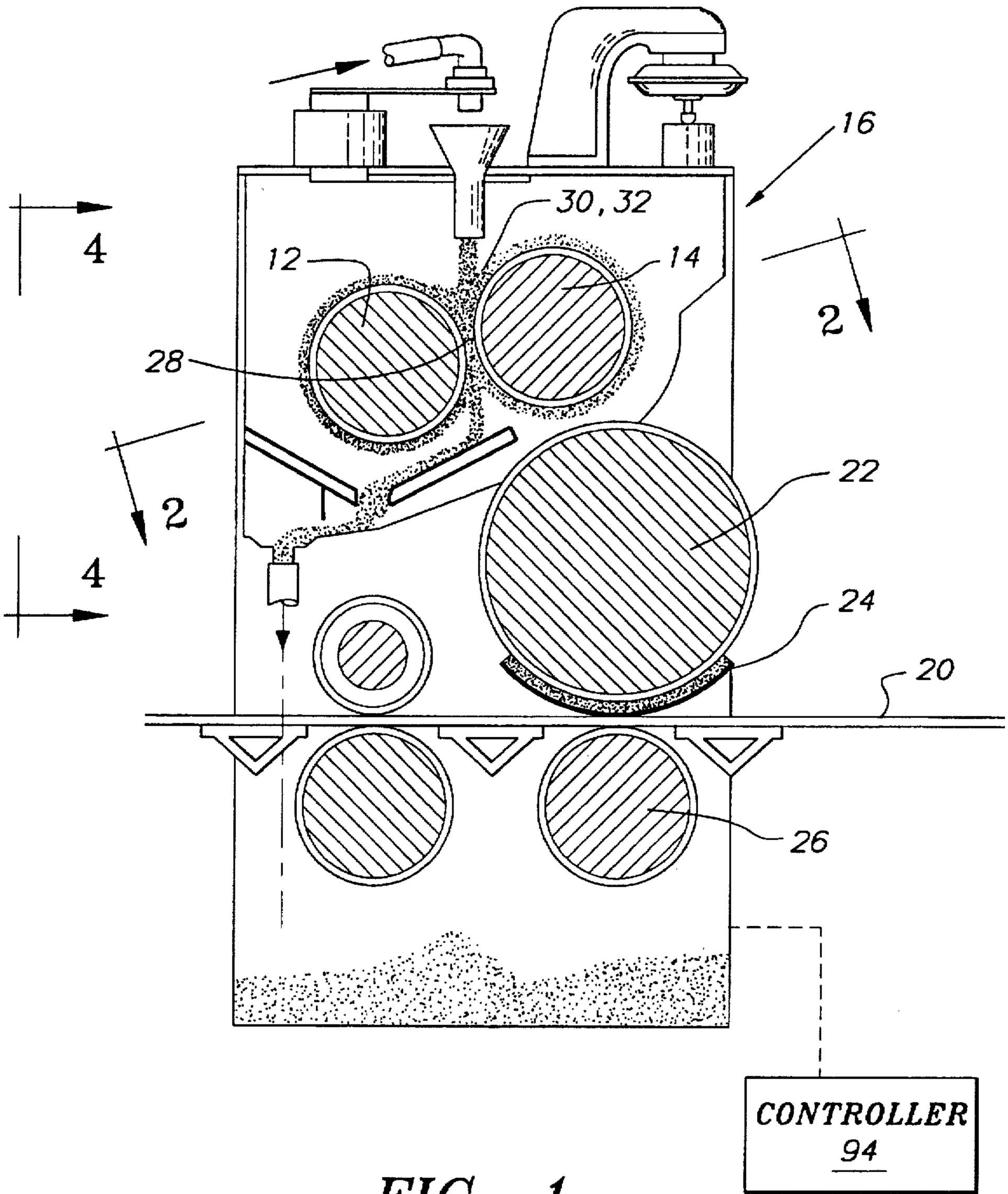


FIG. 1

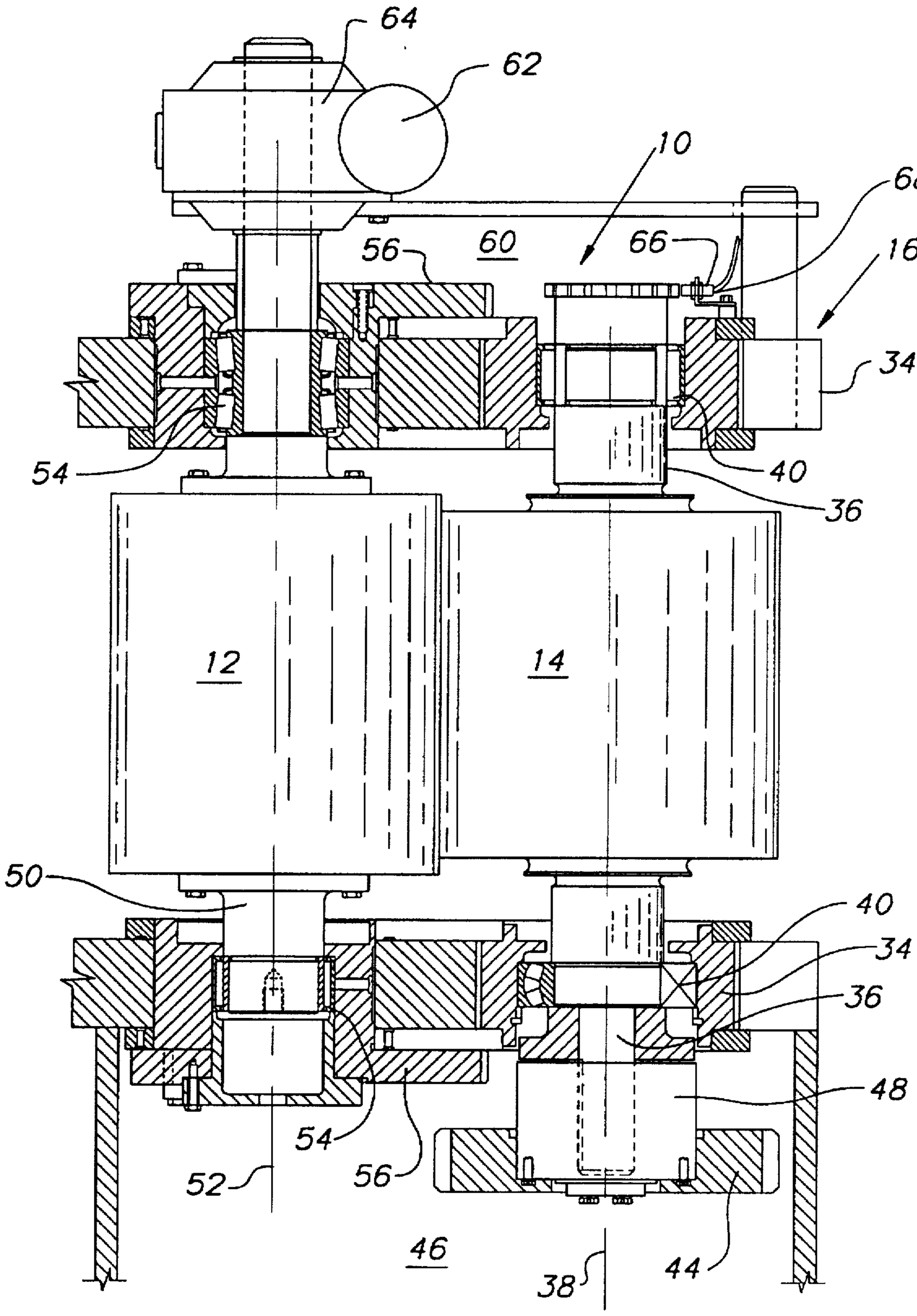

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FIG. 2

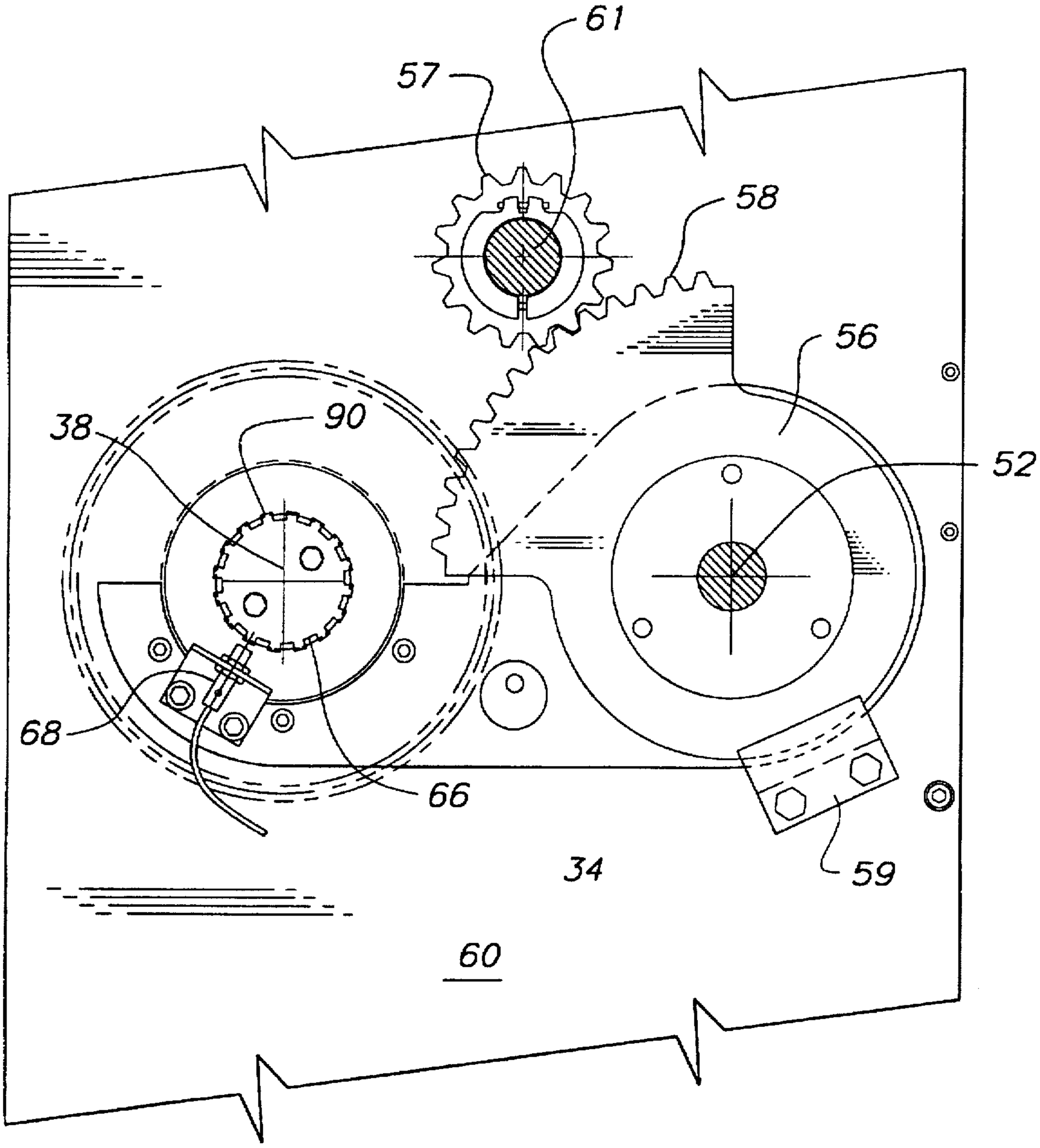

FIG. 3

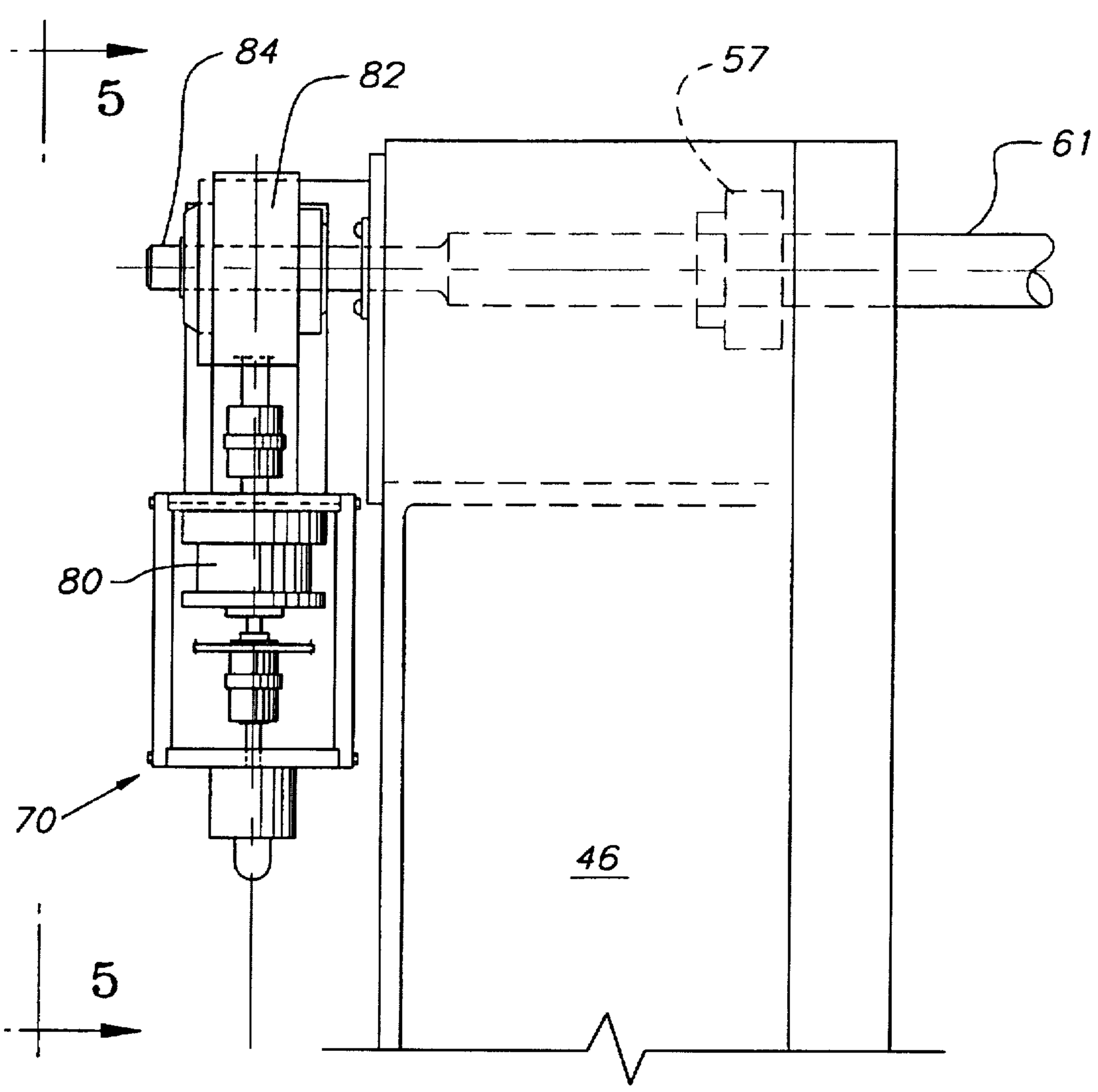

FIG. 4

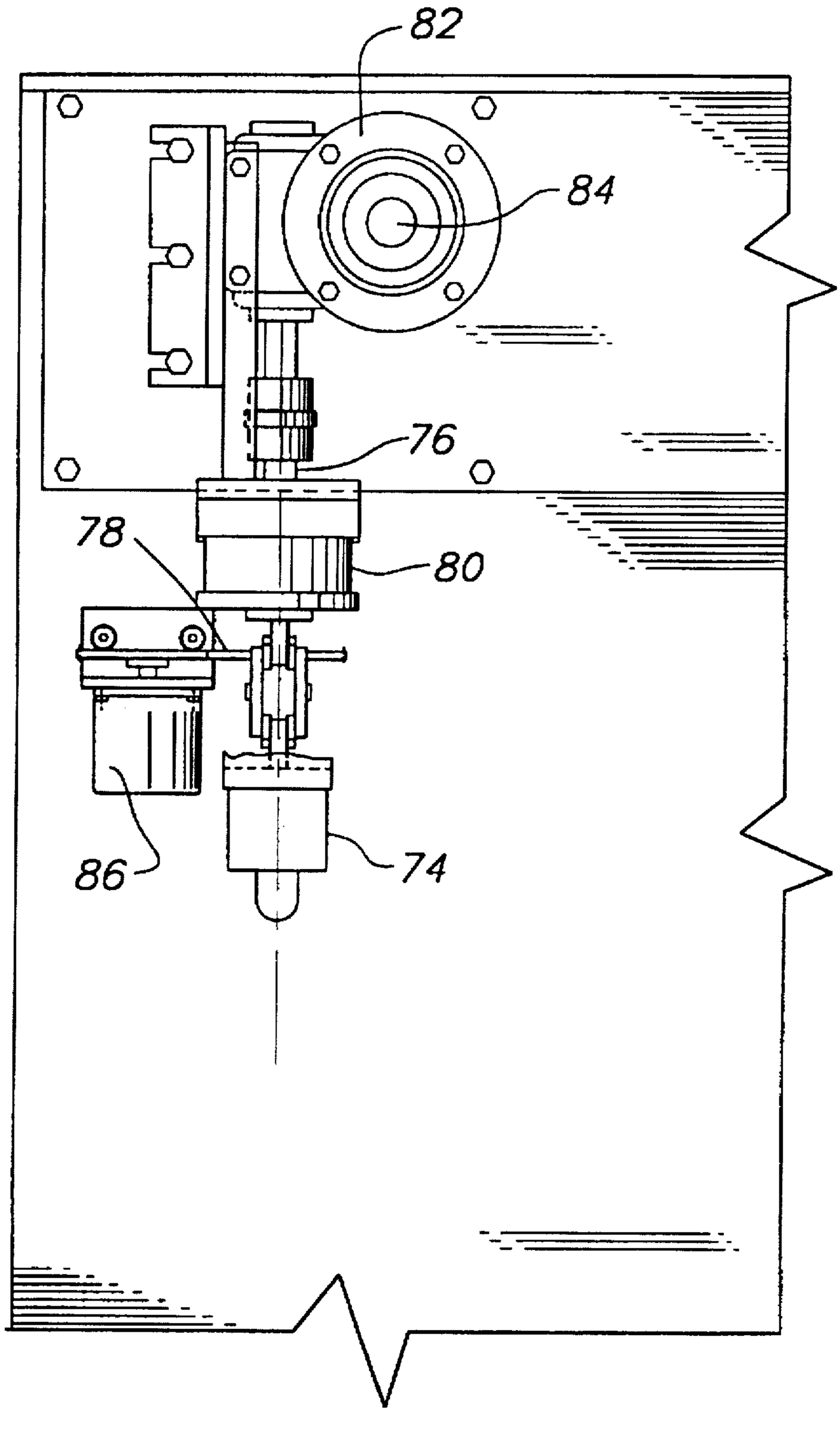

FIG. 5

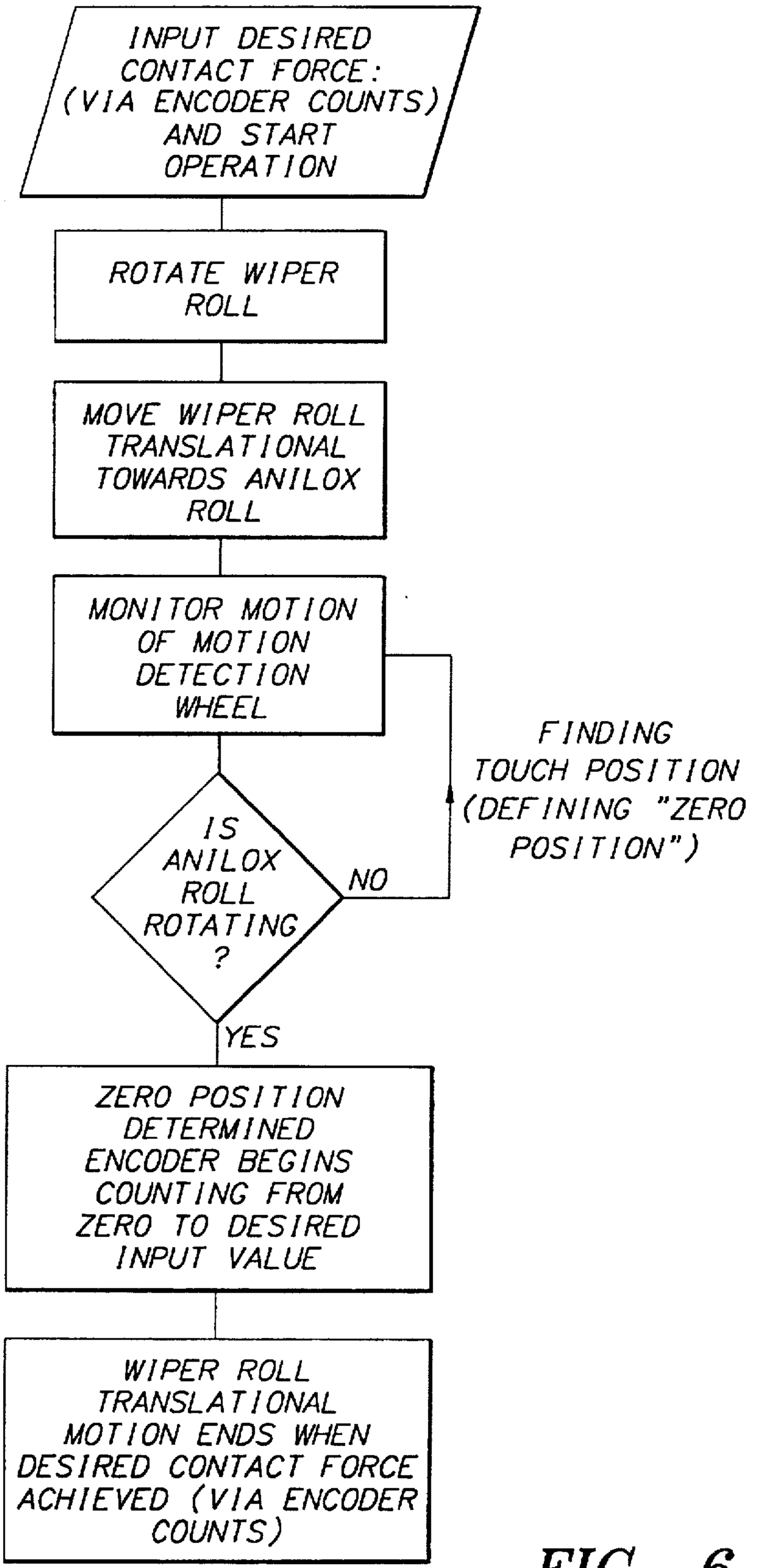
INPUT DESIRED CONTACT FORCE: (VIA ENCODER COUNTS) AND START OPERATION
ROTATE WIPER ROLL
MOVE WIPER ROLL TRANSLATIONAL TOWARDS ANILOX ROLL
MONITOR MOTION OF MOTION DETECTION WHEEL
IS ANILOX ROLL ROTATING ?
NO
FINDING TOUCH POSITION (DEFINING "ZERO POSITION")
YES
ZERO POSITION DETERMINED ENCODER BEGINS COUNTING FROM ZERO TO DESIRED INPUT VALUE
WIPER ROLL TRANSLATIONAL MOTION ENDS WHEN DESIRED CONTACT FORCE ACHIEVED (VIA ENCODER COUNTS)

FIG. 6

METHOD OF AND APPARATUS FOR LOADING A WIPER ROLL AGAINST AN ANILOX ROLL

FIELD OF THE INVENTION

This invention relates to a two roll inking system in a flexographic printing system and more particularly to a method of automatically loading one of the rolls, a wiper roll, against the other roll, an anilox roll.

BACKGROUND OF THE INVENTION

In printing, there are numerous ways of transferring the ink to a substrate on which to print. One of these methods is flexographic printing, which is a process that uses rubber or another suitable material as a printing plate carried on a cylinder, to convey the image to the substrate, such as a corrugated board. There are several methods of getting the ink from its supply, such as a fountain, to the printing plate and ensuring delivery of the proper amount of ink.

One of the most common methods of ink delivery is to use an anilox roll. The anilox roll is flexible and has numerous small cells to hold the ink. The number of cells can vary from 30,000 to 300,000 cells per square inch. The anilox roll with ink transfers the ink to the printing plate. There are two common style machines or methods to fill the cells of the anilox roll and properly meter the ink. The two methods are using a doctor blade in conjunction with the anilox roll and using a wiper roll in conjunction with the anilox roll. This second style machine or method is sometimes referred to as two (2) roll inking or metering system.

The invention relates to a machine that uses the wiper roll to meter the ink to the anilox roll. Therefore, the prior art of this style of machine and method will be discussed in further detail. The anilox roll and the wiper roll form a nip created by the contact of these rolls together. This nip and the rolls form a trough which acts as an ink fountain. The contact force between the wiper roll and the anilox roll determines the amount of ink film which remains in the cells and on the anilox roll. This ink will be transferred to the printing plate. The minimum contact force occurs when the wiper roll just touches or "kisses" the surface of the anilox roll with enough force to form the nip and hold ink.

It has been recognized that to adjust the contact force, the wiper roll is mounted eccentrically in a housing relative to a frame. Rotation of the housing in the frame results in translational movement of the wiper roll relative to the anilox roll. The operator rotates a mechanical adjusting mechanism, such as a wrench, coupled to a gear engaging a rack on the housing in order to rotate the housing. The rotation moves the wiper roll translationally into or out of contact with the anilox roll. This movement is typically called the opening or closing of the wiper to the anilox roll. With this manual system, the operator could "feel" when the rolls initially make contact. The minimum contact force is defined as the "zero position."

One of the reasons for eccentrically mounting the wiper roll, is that the wiper roll in a flexo ink system has an elastic-type covering, such as rubber or another synthetic material, which is subject to wear. A worn roll can be removed from the ink fountain and refinished to produce a smoother wiping surface. However, this refinishing process reduces the diameter of the roll. In addition, the normal wear of the wiper roll from running the machine reduces the diameter of the wiper roll. Therefore, the center or longitudinal axis of the wiper roll needs to be adjusted in order to get the proper contact force.

While an operator with years of experience can tell by the resistance of the wrench that the wiper roll is in proper position therein giving the proper mount of contact force between rolls, it is desired to replace the manual movement by an automatic process so as to increase automation and speed production allowing the operator to perform other functions.

However, the automatic process does not have the benefit of the operator feeling the contact. Moreover, the contact torque cannot be adequately determined using feedback methods. It is therefore desired to have an apparatus for and a method of loading the wiper roll against the anilox roll wherein the "zero position" can be determined reliably and mechanically.

SUMMARY OF THE INVENTION

The present invention provides a method of and apparatus for loading a wiper roll against an anilox roll. The wiper roll and the anilox roll each have a longitudinal rotational axis. The wiper roll is rotated about its longitudinal rotational axis and moved in a translational direction towards the anilox roll. A controller detects rotational movement of the anilox roll and stops the translation movement of the wiper roll towards the anilox roll at a specific time after detecting the rotational movement of the anilox roll in order to properly load the wiper roll against the anilox roll.

One object, feature, and advantage resides in the provision of mechanically reliably loading the wiper roll against the anilox roll giving a true and consistent "zero position."

In the preferred embodiment, the controller loads the wiper roll with a desired specific contact force by waiting a specific time after detecting the rotational movement of the anilox roll, by determining the rate of translational movement of the wiper roll, and the position of the longitudinal axis of the wiper roll.

Another object, feature, and advantage resides in the provision of the capability of allowing the controller to continue rotating the eccentric housing therein moving the wiper roll translationally until an operator-selected contact force is achieved between the wiper roll and the anilox roll.

Other objects, aspects, and advantages of the present invention will be apparent to those skilled in the art upon reading the specification, drawings, and claims which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. **1** is a simplified side elevation view of a print station of a corrugated box manufacturing machine having an apparatus for loading a wiper roll against an anilox roll in accordance with the present invention;

FIG. **2** is a cross-section view of the print station from above taken along line **2—2** in FIG. **1** showing the location of the wiper roll and the anilox roll;

FIG. **3** is side view of the upper portion of the print station showing a housing for eccentrically mounting the wiper roll;

FIG. **4** is a rear view, referred to as a gear side, of the upper portion of the print station taken along line **4—4** in FIG. **1** showing the drive means for rotating the housing carrying the wiper roll;

FIG. **5** is a side elevation of the upper portion of the print station on the gear side taken along line **5—5** in FIG. **4**

showing the drive means for rotating the housing carrying the wiper roll; and

FIG. **6** is a schematic of the control process.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to the drawings, where like elements are identified by like numerals, there is shown in FIG. **2** a preferred embodiment of an apparatus for automatically loading a wiper roll **12** against an anilox roll **14** according to the invention designated by the numeral **10**.

Referring to FIG. **1**, a print station **16** in a corrugated box manufacturing machine, commonly referred to as a flexo folder gluer, prints on the upper surface of a corrugated board **20** as the board passes through the print station **16**. The print station **16** has a print cylinder **22** having a printing plate **24** to place the image on the corrugated board **20**. The print station **16** has an impression cylinder **26** to support the corrugated board **20** and act as an anvil for the printing plate **24**.

The printing plate **24** has the image that is to be printed on the upper surface of the corrugated board **20**. The printing plate **24** of the printing cylinder **22** receives the ink from the anilox roll **14** by the print plate **24** contacting the anilox roll **14** as the printing cylinder **22** and the anilox roll **14** rotate.

The anilox roll **14** and the wiper roll **12** form a nip **28** created by the contact of these rolls. This nip **28** and the rolls **12** and **14** form a trough **30** which acts as an ink fountain **32**. The anilox roll **14** receives the ink from the ink trough **30**.

The contact force between the wiper roll **12** and the anilox roll **14** determines the amount of ink film which remains on the anilox roll **14** along with the ink in the cells of the anilox roll. This ink will be transferred to the printing plate **24**. The minimum contact force occurs when the wiper roll **12** just touches or "kisses" the surface of the anilox roll **14** with enough force to form a nip and hold ink. This minimum contact force is defined as the "zero position."

The wiper roll **12** in the print station **16** in the corrugated box manufacturing machine has an elastic-type covering, such as rubber or another synthetic material, which is subject to wear. As indicated in the Background of the Invention, the wearing of the wiper roll **12** by normal use or refinishing the wiper roll **12** reduces the diameter of the wiper roll **12**. The wiper roll **12**, therefore, is translationally movable relative to the anilox roll **14** in order to achieve the proper contact force. This process and associated structure for moving the wiper roll **12** is described below.

Referring to FIG. **2**, the anilox roll **14** is cylindrical and symmetric about a longitudinal axis **38** extending through the ends of the anilox roll **14**. The anilox roll **14** has a shaft **36** extending from both ends of the roll **14** along the longitudinal axis **38**. The shaft **36** is rotatably mounted in a pair of bearings **40**, allowing the anilox roll **14** to be rotated about its longitudinal axis **38**. The bearings **40** are carried in a frame **34** of the print station **16**.

Mounted on the shaft **36** at one end of the anilox roll **14** is a gear **44**. This end of the anilox roll **14** and the print station **16** is commonly referred to as a gear side **46**. The gear **44** is connected to the machine gear train. An over-running clutch **48** is interposed between the shaft **36** and the gear **44**. The machine gear train rotates the anilox roll **14** at production speed to print on the corrugated board **20** passing between the printing plate **24** of the print cylinder **22** and the impression cylinder **26**. The over-running clutch **48** permits free rotation of the anilox roll **14** when the machine is idle.

Referring to FIG. **2**, the wiper roll **12**, likewise, is cylindrical and symmetric about a longitudinal axis **52** extending through the ends of the wiper roll **12**. The wiper roll **12** has a shaft **50** extending from both ends along the longitudinal axis **52**. The shaft **50** is rotatably mounted in a pair of bearings **54** allowing the wiper roll **12** to be rotated about its longitudinal axis **52**. Each bearing **54** is carried by a housing **56**. The housings **56** are rotatably mounted in the frame **34**.

The bearing **54** is eccentrically mounted in the housing **56** such that rotation of the housing **56** will move the longitudinal axis **52** of the wiper roll **12** towards or away from the longitudinal axis **38** of the anilox roll **14**. This movement is commonly referred to as the opening or closing of the wiper roll **12** to the anilox roll **14**.

Referring to FIG. **3** showing the non-gear side, commonly referred to as a drive side **60**, the housing **56** has a rack **58**, a series of teeth, that are engaged by a pinion, gear, **57** to rotate the housing **56**. In addition, a bracket **59** carded by the frame **34** slidable guides the rotation of the housing **56**. The gear side **46** has a similar arrangement, and a shaft **61** extends between the pair of pinions **57**. The rotation of the housing **56** typically moves the longitudinal axis **52** of the wiper roll **12** translationally less than ⅛ inch towards and away from the longitudinal axis **30** of the anilox roll **14**.

Referring back to FIG. **2**, connected to the shaft **50** of the wiper roll **12** at the non gear side, commonly referred to as the drive side **60**, is a constant speed motor **62** for rotating the wiper roll **12**. The constant speed motor **62** is connected to the shaft **50** through a reduction gear **64**. The constant speed motor **62** rotates the wiper roll **12** during production to keep the ink flowing in the ink trough **30**. The wiper roll **12** rotates at a rate slower than the anilox roll **14** during typical production runs.

The improvement **10** for automatically loading a wiper roll **12** against an anilox roll **14** includes a motion detection wheel **66** on the anilox roll **14**, a sensor **68**, as seen in FIG. **3**, and a drive means **70** for moving the wiper roll **12** towards and away from the anilox roll **14**, as seen in FIGS. **4** and **5**.

Referring to FIGS. **4** and **5** showing the gear side **46** of the machine, the drive means **70** has an air motor **74**, best seen in FIG. **5**, connected to a drive shaft **76**. The drive shaft **76** comes in several sections and includes several interposed components. The components include a pair of reduction gear assemblies **80** and **82**. One of the reduction gear assemblies **82**, at the upper end of the shaft **76**, engages an extension **84**. One of the gears, not shown, of the reduction gear assembly **82** encircles one end of the extension **84**. The gear is keyed to the extension **84** so that they rotate together. The extension **84**, at the other end, is coupled to the pinion **57**, shown in FIG. **3** and in hidden line in FIG. **4**, and the shaft **61** in proximity to the air motor **74**. An encoder **86** is connected to the shaft **76** by a series of gears **78**.

Referring back to FIG. **3**, the motion detection wheel **66** is mounted on the shaft **36** of the anilox roll **14** on the drive side **60** of the print station **16**. The motion detection wheel **66** has a series of teeth **90**. The series of teeth **90** of the motion detection wheel **66** work in cooperation with the sensor **68** to determine when the anilox roll **14** is rotating. The sensor **68** in the preferred embodiment is a proximity switch such as a QS132 proximity switch sold by MC Technologies. The sensor **68** is typically positioned in the preferred embodiment such that the end of the sensor **68** is 0.040 inches from the teeth **90** of the motion detection wheel **66**.

In Operation

The flexo folder gluer **18**, or the print station **16**, has a controller **94**, as shown in schematic in FIG. **1**, which controls the loading of the wiper roll **12** against the anilox

roll **14**. Referring to FIG. **6**, upon activation by the operator, the controller **94** begins the rotation of the wiper roll **12** by powering the constant speed motor **62**, shown in FIG. **2**. In addition, the controller **94** simultaneously or slightly prior to or after beginning the rotation of the wiper roll **12**, begins the movement of the wiper roll **12** towards the anilox roll **14**.

The controller **94** performs this operation of moving the wiper roll **12** translationally, by having the air motor **74** rotate the pinion **57** on the gear side **46** through the drive shaft **76**, and the extension **84**. The pinion **57** on the drive side **60** of the machine is coupled to the pinion **57** on the gear side **46** via the shaft **61**. The drive shaft **76** includes the pair of reduction gear assemblies **80** and **82**. The pinions **57** each engage the rack **58** on one of the housing **56**, respectively, rotating the housing **56**. The rotation of the housing **56** moves the wiper roll **12** in the translational direction towards the anilox roll **14**.

The controller **94** receives information from the sensor **68** which monitors movement of the anilox roll **14**. When the sensor **68** determines the anilox roll **14** begins to rotate, the sensor **68** sends the signal to the controller **94**. The sensor **68** detects the motion of the anilox roll **14** by watching for movement of the motion detection wheel **66**. As indicated above, the anilox roll **14** will begin to rotate when the wiper roll **12**, which is rotated by the constant speed motor **62**, engages the anilox roll **14** with sufficient contact force to begin rotation of the anilox roll **14** (i.e. the "zero position"). The over-running clutch **48** allows the anilox roll **14** to rotate even though the machine gear train is not rotating.

The encoder **86** which is connected to the drive shaft **76** forwards a signal to the controller **94**, therein the controller **94** knows the position of the drive shaft **76** and through an algorithm related to the geometry of the system (i.e. gear reduction and gear size), determines the position of the longitudinal axis **52** of the wiper roll **12**. In the preferred embodiment, the controller **94** resets the encoder **86** to zero (i.e., the "zero position") when the sensor determines the anilox roll **14** has begun to rotate.

When the controller **94** determines the "zero position," the controller **94** stops the translational movement of the wiper roll **12** either immediately or after a specific time period. The controller **94** determines when to stop the translational movement of the wiper roll **12** by considering one, some, or all of these factors: the contact force desired as input by the operator, the rate of translational movement of the wiper roll **12**, and the size of the wiper roll **12**. The size of the wiper roll **12** is determined by the controller **94** by knowing the position of the longitudinal axis **52** of the wiper roll **12** through the encoder **86** at the time the anilox roll **14** begins to rotate. In the preferred embodiment, the contact force is input as the number of encoder counts after the zero position.

With the wiper roll **12** properly loaded against the anilox roll **14**, the printing of the corrugated board **20** can begin with the proper mount of ink engaging the printing plate **24**, thus the printing upper surface of the corrugated board **20**.

In addition, the controller **94** by determining the "zero position" can prevent the wiper roll **12** from inadvertently being moved out of contact with the anilox roll **14**. If the rolls **12** and **14** were separated, the ink in the trough **30** would drain into the machine.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification, as indicating the scope of the invention.

I claim:

1. A method of loading a first roll against a second roll comprising the following steps:

rotating one of the rolls;

moving the rolls relative to each other in a translational direction until the rolls contact each other;

detecting an initial rotational movement of the other roll when it is caused to rotate by contacting the rotating one roll; and

stopping the relative movement in the translational direction of the rolls upon detecting said initial rotation.

2. A method of loading a wiper roll against an anilox roll comprising the following steps:

providing the wiper roll and the anilox roll each with a longitudinal rotational axis;

rotating the wiper roll about the longitudinal rotational axis of the wiper roll;

moving the wiper roll translationally, in a direction perpendicular to the longitudinal axis, towards the anilox roll;

detecting an initial rotational movement of the anilox roll when it is caused to rotate by contacting the rotating wiper roll; and

stopping the translational movement of the wiper roll towards the anilox roll at a specific time after detecting the rotational movement of the anilox roll.

3. A method of loading a wiper roll against an anilox roll comprising the following steps:

providing the wiper roll and the anilox roll each with a longitudinal rotational axis;

rotating the wiper roll about the longitudinal rotational axis of the wiper roll;

moving the wiper roll translationally, in a direction perpendicular to the longitudinal axis, towards the anilox roll;

detecting rotational movement of the anilox roll; and

stopping the translational movement of the wiper roll towards the anilox roll at a specific time after detecting the rotational movement of the anilox roll, wherein the specific time after detecting the rotational movement of the anilox roll is based upon a specific contact force desired, the rate of translational movement of the wiper roll, and the position of the longitudinal axis of the wiper roll.

4. In an apparatus having a first roll and a second roll, each roll having a longitudinal axis, each roll being rotatable about its longitudinal axis, the first roll having a gear for coupling the first roll to a drive means, the drive means rotating at a rate associated with the production rate, an overrunning clutch associated with the first roll for allowing rotation of the first roll without rotation of the drive means, eccentric mounting means for rotatably mounting the second roll in a housing wherein rotation of the eccentric mounting means moves the longitudinal axis of the second roll relative to the first roll, the eccentric mounting means having an engagement means adapted to allow rotation of the eccentric mounting means, a motor carried by the frame for rotating the second roll, wherein the improvement comprises:

a. drive means engaging the engagement means for rotating the eccentric mounting means therein moving the second roll towards and away from the first roll,

b. sensor means for detecting rotation of the first roll, and

c. control means for moving the drive means and beginning rotation of the motor for rotating the second roll in

its longitudinal axis, determining when the second roll contacts the first roll by detecting rotation of the first roll by the sensor means, and stopping the drive means therein stopping the translational movement of the second roll.

5. In an apparatus as in claim **4** wherein further comprising feedback means for measuring the angular displacement of the eccentric mounting means.

6. In an apparatus as in claim **5** wherein the control means calculates the stopping of the translational movement of the second roll in response to a specific contact force desired, the rate of translational movement of the second roll, the position of the second roll from the feedback means when the second roll contacts the first roll by detecting rotation of the first roll by the sensor means.

7. In a printer for printing on a substrate, the printer having an anilox roll and a wiper roll,

the anilox roll having a longitudinal axis, and a shaft along the longitudinal axis, the anilox roll being rotatable about its shaft, a gear coupled to the shaft of the anilox roll for rotating the anilox roll with a machine gear train of the printer, clutch means for allowing rotation of the anilox roll without rotation of machine gear train;

the wiper roll having a longitudinal axis, and a shaft along the longitudinal axis, the wiper roll being rotatable about its shaft, a housing having a rack, the housing rotatably mounted in the frame, a pinion rotatably mounted to the frame for engaging the rack of the housing for rotating the housing relative to the frame,

a motor carried by the frame and movable with the shaft of the wiper roll for rotating the wiper roll;

wherein the improvement comprises

a. a motor for rotaing the pinion therein moving the eccentric housing of the wiper roll, the eccentric housing moving the longitudinal axis of the wiper roll translationally towards and away from the anilox roll;

b. motion detector mounted to the shaft of the anilox roll,

c. sensor means for detecting rotation of the motion detector of the anilox roll, and

d. control means for moving the drive means and beginning rotation of the motor for rotating the wiper roll in its longitudinal axis, determining when the wiper roll contacts the anilox roll by detecting rotation of the anilox roll by the sensor means, and stopping the drive means therein stopping the translational movement of the wiper roll.

8. In a printer as in claim **7** wherein further comprising feedback means for measuring the angular displacement of the eccentric housing.

9. In a printer as in claim **8** wherein the control means calculates the stopping of the translational movement of the wiper roll in response to a specific contact force desired, the rate of translational movement of the wiper roll, the position of the wiper roll from the feedback means when the wiper roll contacts the anilox roll by detecting rotation of the anilox roll by the sensor means.

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